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09/838,493	04/19/2001	Dinesh Chopra	303.658US1	8948

7590

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Schwegman, Lundberg,  
Woessner & Kluth, P.A.  
Attn: Daniel J. Kluth  
P.O. Box 2938  
Minneapolis, MN 55402

EXAMINER

NGUYEN, KHIEM D

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 11/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/838,493

Applicant(s)

DINESH CHOPRA

Examiner

Khiem D Nguyen

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 17 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-9, 11-14, 16-41 and 43-57 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11-14, 16-41 and 43-57 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 April 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s): \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

### DETAILED ACTION

The non-final rejection as set forth in paper No. (7) is withdrawn in response to applicants' amendments.

A new rejection is made as set forth in this Office Action.

Claims (1-9, 11-14, 16-41, and 43-57) are pending in the application.

#### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (U.S. Patent 6,555,909) in view of Lashmore et al. (U.S. Patent 5,456,819).

In re claim 1, Lopatin discloses a method of metallizing a substrate, comprising (col. 5, line 19 to col. 6, line 54 and **FIG. 3**): depositing a dual-purpose layer (**FIG. 3: 232**) on the substrate wherein a first purpose is to serve as a barrier layer and a second purpose is to serve as a seed layer (col. 5, lines 42-47); and electrochemically depositing a conductive interconnect layer (**FIG. 3: 236**) on the surface of the dual- purpose layer using a second electrolyte (col. 5, line 62 to col. 6, line 43).

Lopatin does not explicitly disclose electrochemically reducing oxides on the surface of the dual-purpose layer using a first electrolyte where the first electrolyte is the cation of the anode in an electrochemical reaction cell.

Lashmore discloses electrochemically reducing oxides on the surface of the dual-purpose layer (tungsten) using a first electrolyte where the first electrolyte is the cation of the anode in an electrochemical reaction cell (col. 3, line 46 to col. 4, line 16 and **FIGS. 1-6**). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lopatin and Lashmore to enable the process of electrochemically reducing oxides on the surface of the dual-purpose layer of Lopatin to be performed and furthermore the oxide of tungsten can be reduced without dissolving copper (col. 3, lines 64-65).

In re claim 2, Lopatin discloses wherein the dual-purpose layer comprises a material capable of reducing diffusion of the conductive interconnect material into surrounding materials, and wherein the dual-purpose layer comprises a material having a resistivity that allows electrochemical deposition of the conductive interconnect material (col. 5, line 19 to col. 6, line 54).

In re claims 3 and 4, Lopatin discloses wherein the dual-purpose layer comprises a material selected from the group consisting of tungsten (col. 6, lines 49-51).

In re claim 5, Lopatin discloses wherein the conductive interconnect material comprises copper (col. 6, lines 54-63).

In re claim 6, Lashmore discloses wherein a voltage of at least about  $-0.4\text{ V}$  is applied during both the electrochemically reducing step and the electrochemically depositing step for a time period of 2 minutes but fails to explicitly disclose the voltage ranges and time duration as recited in present claim 6. However, There is no evidence indicating the voltage range applied and time duration during both the electrochemically

reducing step and the electrochemically depositing step are critical and it has been held that it is not inventive to discover the optimum or workable range or time duration of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claims 7-9, similar as expressed in claim 6 above, there is no evidence indicating the range of the current applied during both the electrochemically reducing step and the electrochemically depositing step is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05.

2. Claims 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (U.S. Patent 6,555,909) in view of Lashmore et al. (U.S. Patent 5,456,819).

In re claim 12, Lopatin discloses a method of metallizing a substrate, comprising (col. 5, line 19 to col. 6, line 54 and **FIG. 3**): depositing a dual-purpose layer (**FIG. 3: 232**) on the substrate wherein a first purpose is to serve as a barrier laver and a second purpose is to serve as a seed layer (col. 5, lines 42-47); and electrochemically depositing a conductive interconnect layer (**FIG. 3: 236**) on the surface of the dual- purpose layer using a second electrolyte (col. 5, line 62 to col. 6, line 43).

Lopatin does not explicitly disclose electrochemically reducing oxides on the surface of the dual-purpose layer in an electrochemical reaction cell comprising an anode formed from a material that can be oxidized in the presence of the material comprising the dual-purpose layer and wherein the electrochemical reaction cell contains a first electrolyte comprising the cation of the material used to form the anode.

Lashmore discloses electrochemically reducing oxides on the surface of the dual-purpose layer (tungsten) in an electrochemical reaction cell comprising an anode formed from a material that can be oxidized in the presence of the material comprising the dual-purpose layer wherein the electrochemical reaction cell contains a first electrolyte comprising the cation of the material used to form the anode (col. 3, line 46 to col. 4, line 16 and **FIGS. 1-6**). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lopatin and Lashmore to enable the process of electrochemically reducing oxides on the surface of the dual-purpose layer of Lopatin to be performed and furthermore the oxide of tungsten can be reduced without dissolving copper (col. 3, lines 64-65).

In re claim 11, Lopatin discloses wherein the anode is formed from titanium (col. 6, lines 49-54).

In re claims 13 and 14, Lopatin discloses wherein the anode comprises titanium (col. 6, lines 49-54) and Lashmore discloses wherein the first electrolyte comprises titanium trichloride, titanium sulfate, titanium bromide, titanium trichloride, titanium iodide, titanium fluoride, or mixtures thereof.

3. Claims 16-25 and 28-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (U.S. Patent 6,555,909) in view of Lashmore et al. (U.S. Patent 5,456,819).

In re claim 25, Lopatin discloses a method of metallizing a substrate, comprising (col. 5, line 19 to col. 6, line 54 and **FIG. 3**): depositing a dual-purpose layer (**FIG. 3: 232**) on the substrate wherein a first purpose is to serve as a barrier layer and a second purpose is to serve as a seed layer (col. 5, lines 42-47); and electrochemically depositing a conductive interconnect layer (**FIG. 3: 236**) on the surface of the dual-purpose layer using a second electrolyte (col. 5, line 62 to col. 6, line 43).

Lopatin does not explicitly disclose electrochemically reducing oxides on the surface of the dual-purpose layer utilizing a first electrolyte in an electrochemical bath having an anode and a cathode and wherein the first electrolyte contains the cationic species of the material comprising the first anode.

Lashmore discloses electrochemically reducing oxides on the surface of the dual-purpose layer (tungsten) utilizing a first electrolyte in an electrochemical bath having an anode and a cathode and wherein the first electrolyte contains the cationic species of the material comprising the first anode (col. 3, line 46 to col. 4, line 16 and **FIGS. 1-6**). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lopatin and Lashmore to enable the process of electrochemically reducing oxides on the surface of the dual-purpose layer of Lopatin to be performed and furthermore the oxide of tungsten can be reduced without dissolving copper (col. 3, lines 64-65).

In re claims 16, Lopatin and Lashmore disclose wherein the electrochemically reducing step is performed in a first electrochemical reaction cell and the electrochemically depositing step is performed in a second electrochemical reaction cell (Lopatin, col. 5, line 62 to col. 6, line 43) and (Lashmore, col. 3, line 45 to col. 4, line 44).

In re claim 17, Lashmore discloses wherein the electrochemically reducing step and the electrochemically depositing step are performed in a single electrochemical reaction cell (col. 3, line 45 to col. 4, line 44).

In re claim 18, Lopatin and Lashmore disclose wherein the electrochemical reducing step is performed using a first anode and the electrochemical depositing step is performed using a second anode (Lopatin, col. 5, line 62 to col. 6, line 43) and (Lashmore, col. 3, line 45 to col. 4, line 44).

In re claim 19, Lopatin and Lashmore disclose wherein the electrochemical reducing step and the electrochemical depositing step are performed using a single anode. Lopatin, col. 5, line 62 to col. 6, line 43) and (Lashmore, col. 3, line 45 to col. 4, line 44).

In re claims 20 and 21, Lopatin discloses wherein the dual-purpose layer comprises a material selected from the group consisting of tungsten (col. 6, lines 49-51).

In re claim 22, Lopatin discloses wherein the conductive interconnect material comprises copper (col. 6, lines 54-63).

In re claims 23-24, Lopatin discloses wherein the first anode is formed from titanium (col. 6, lines 49-54).



In re claim 28, Lashmore discloses wherein a voltage of at least about  $-0.4$  V is applied during both the electrochemically reducing step and the electrochemically depositing step for a time period of 2 minutes but fails to explicitly disclose the voltage ranges and time duration as recited in present claim 6. However, There is no evidence indicating the voltage range applied and time duration during both the electrochemically reducing step and the electrochemically depositing step are critical and it has been held that it is not inventive to discover the optimum or workable range or time duration of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claims 29-31, similar as expressed in claim 28 above, there is no evidence indicating the range of the current applied during both the electrochemically reducing step and the electrochemically depositing step is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05.

4. Claims 26-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (U.S. Patent 6,555,909) in view of Lashmore et al. (U.S. Patent 5,456,819).

In re claims 26 and 27, Lopatin discloses a method of metallizing a substrate, comprising (col. 5, line 19 to col. 6, line 54 and **FIG. 3**): depositing a dual-purpose layer

(**FIG. 3: 232**) on the substrate wherein a first purpose is to serve as a barrier layer and a second purpose is to serve as a seed layer (col. 5, lines 42-47); and electrochemically depositing a conductive interconnect layer (**FIG. 3: 236**) on the surface of the dual-purpose layer utilizing a second electrolyte (col. 5, line 62 to col. 6, line 43).

Lopatin does not explicitly disclose electrochemically reducing oxides on the surface of the dual-purpose layer utilizing a first electrolyte.

Lashmore discloses electrochemically reducing oxides on the surface of the dual-purpose layer (tungsten) utilizing a first electrolyte (col. 3, line 46 to col. 4, line 16 and **FIGS. 1-6**). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lopatin and Lashmore to enable the process of electrochemically reducing oxides on the surface of the dual-purpose layer of Lopatin to be performed and furthermore the oxide of tungsten can be reduced without dissolving copper (col. 3, lines 64-65).

Additionally, Lopatin discloses wherein the anode comprises titanium (col. 6, lines 49-54) and Lashmore discloses wherein the first electrolyte comprises titanium trichloride, titanium sulfate, titanium bromide, titanium trichloride, titanium iodide, titanium fluoride, or mixtures thereof.

5. Claims 32-41 and 43-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin et al. (U.S. Patent 6,555,909) in view of Lashmore et al. (U.S. Patent 5,456,819).

In re claim 32, 44, 45, and 47, Lopatin discloses a method of metallizing a substrate, comprising (col. 5, line 19 to col. 6, line 54 and **FIG. 3**): depositing a dual-purpose layer (**FIG. 3: 232**) on the substrate wherein a first purpose is to serve as a

barrier layer and a second purpose is to serve as a seed layer (col. 5, lines 42-47); and electrochemically depositing a conductive interconnect layer (**FIG. 3: 236**) on the surface of the dual-purpose layer utilizing a second electrolyte (col. 5, line 62 to col. 6, line 43).

Lopatin does not explicitly disclose electrochemically reducing oxides on the surface of the dual-purpose layer utilizing a first electrolyte.

Lashmore discloses electrochemically reducing oxides on the surface of the dual-purpose layer (tungsten) utilizing a first electrolyte and wherein the first electrolyte comprises the cation of the material from which the conductive interconnect layer is made; a complexing agent; and a pH control agent (col. 3, line 46 to col. 4, line 16 and **FIGS. 1-6**). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of Lopatin and Lashmore to enable the process of electrochemically reducing oxides on the surface of the dual-purpose layer of Lopatin to be performed and furthermore the oxide of tungsten can be reduced without dissolving copper (col. 3, lines 64-65).

Additionally, Lashmore discloses wherein both the electrochemically reducing step and the electrochemically depositing step are performed in a single electrochemical reaction cell utilizing a single electrolyte (col. 3, line 45 to col. 4, line 44).

In re claims 33 and 45, Lopatin discloses wherein the conductive interconnect layer comprises copper (col. 6, lines 54-63) and the electrolyte comprises copper sulfate.

In re claims 34-35 and 46-47, Lashmore discloses wherein the complexing agent is selected from the group consisting of boric acid (col. 4, lines 45-62).

In re claims 36-37 and 48-49, Lashmore discloses wherein the pH control agent is tetramethyl ammonium hydroxide, ammonium hydroxide, or potassium hydroxide (col. 4, lines 45-62).

In re claims 38-41 and 50-53, there is no evidence indicating the pH level is critical and it has been held that it is not inventive to discover the optimum or workable level of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05.

In re claim 54, Lashmore discloses wherein a voltage of at least about  $-0.4$  V is applied during both the electrochemically reducing step and the electrochemically depositing step for a time period of 2 minutes but fails to explicitly disclose the voltage ranges and time duration as recited in present claim 6. However, There is no evidence indicating the voltage range applied and time duration during both the electrochemically reducing step and the electrochemically depositing step are critical and it has been held that it is not inventive to discover the optimum or workable range or time duration of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claims 55-57, similar as expressed in claim 54 above, there is no evidence indicating the range of the current applied during both the electrochemically reducing

step and the electrochemically depositing step is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05.

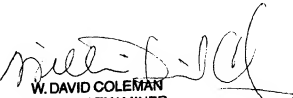
***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (703) 306-0210. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3432 for regular communications and (703) 305-3432 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N.  
November 21, 2003

  
W. DAVID COLEMAN  
PRIMARY EXAMINER